

# Stenting of the superior vena cava in a patient with a total artificial heart

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**F**or patients with decompensated biventricular heart failure refractory to medical management, the total artificial heart (TAH) is a sufficient therapy option. One possible postoperative problem is the compression of the superior vena cava (SVC) caused by bleeding that will lead to tamponade with low output of the TAH.

In a 55-year-old man, such a TAH was implanted as a bridge to transplantation without any perioperative complications. However, 7 months after the patient was discharged home, he was readmitted with signs of congestion of the upper body and low flow of the TAH because of SVC compression caused by pericardial effusion. In an interventional procedure a stent was implanted in the SVC, which led to full recovery of the patient and normal flow patterns of the TAH.

## Clinical Summary

We implanted a TAH (CardioWest temporary Total Artificial Heart System; SynCardia Systems, Inc, Tucson, Ariz) in a 55-year-old man with decompensated biventricular heart failure caused by ischemic cardiomyopathy. The initial evaluation showed that he was not

a candidate for high-urgency transplantation or for only left ventricular assist device implantation because of very bad right ventricular function (right ventricular stroke work index,  $<300 \text{ mm Hg} \times \text{mL/m}^2/\text{beat}$ ; central venous pressure,  $>20 \text{ mm Hg}$ ).

After an initial uneventful course, he was discharged home. Seven months later, the patient was readmitted to our center because of upper body congestion and decreasing flow of the TAH. Computed tomographic (CT) scanning demonstrated a nearly complete compression of the SVC with only minimal rest flow to the right atrium because of pericardial effusion (Figure 1, A) as a result of a tiny bleed of the anastomosis between the outflow cannula and the ascending aorta. In the actual CT scan with contrast medium, no bleeding could be detected, and therefore we abandoned reoperation to avoid the consecutive risks after this long-term TAH implantation.

In cooperation with the department of radiology, we implanted interventional a stent in the compressed SVC. The initial angiographic analysis demonstrated the compression of the SVC, with only minimal rest flow to the right atrium (Figure 1, B). Then a guide-wire was carefully inserted under radioscopic control to avoid blockade of the mechanical valve of the TAH; subsequently, a Wall stent (Boston Scientific Corporation, Natick, Mass) with a 16-mm diameter and a 6-cm length was placed in the SVC. The postinterventional angiographic control showed normal flow over the stented SVC (Figure 2, A). Immediately after the procedure, the flow of the TAH recovered to normal values, and the congestion of the upper body decreased within a few days, so that the patient could be discharged home again only 3 days later. A control CT scan 8 weeks later showed a wide-open stent in the SVC (Figure 2, B) while the patient was still symptom free, and the TAH showed normal flow patterns. The pericardial effusion was constant, and no active bleeding was seen.

## Discussion

Resulting from the shortage of organ donors with increasing numbers of patients with congestive heart failure, the development of ventricular assist devices has been required and is today an accepted

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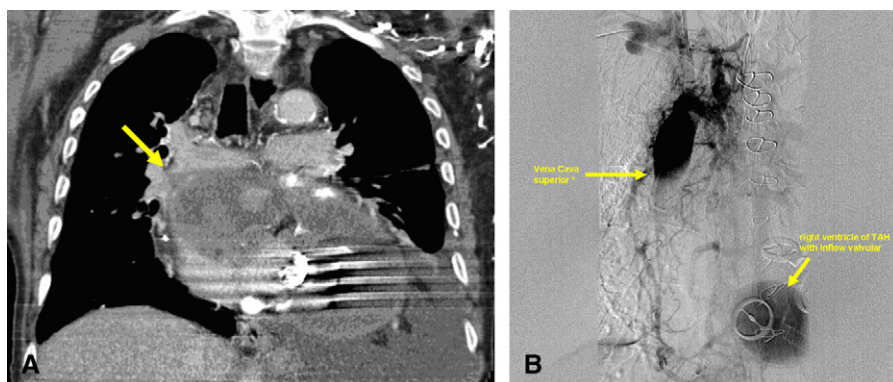
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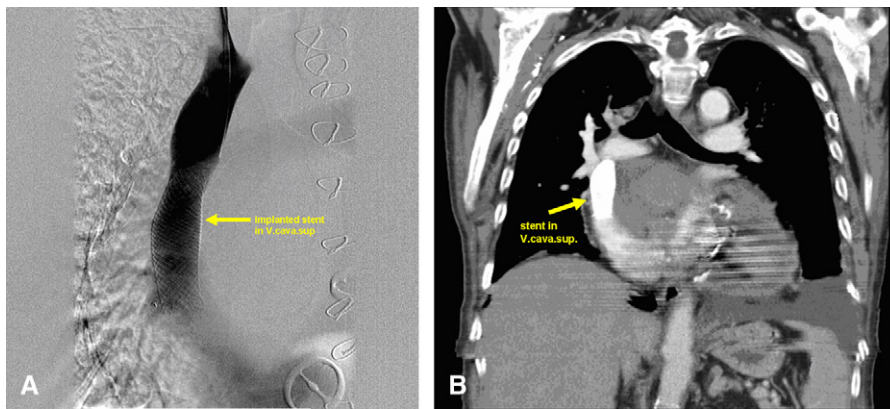
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**Figure 1. A, Reconstructed computed tomographic scan of the thorax. The arrow indicates the nearly completely interrupted superior vena cava by massive pericardial effusion. Active bleeding is excluded. B, Preinterventional angiography shows a nearly completely restricted superior vena cava. TAH, Total artificial heart.**



**Figure 2.** A, Postinterventional angiography of the superior vena cava (*V.cava.sup*) with expanded stent and normal inflow into the right atrium. B, Reconstructed computed tomographic scan of the thorax 8 weeks after intervention demonstrated the open stent. *V.cava.sup*, Superior vena cava.

therapy option in many of these patients. However, there is still a subgroup that is not eligible for this therapy option, especially patients with decompensated biventricular heart failure that is refractory to medical management with consecutive beginning secondary organ failure. For this subgroup, the TAH is a sufficient therapy option<sup>1,2</sup> if they fulfill the selection criteria.<sup>3</sup> Among the possible complications<sup>1-4</sup> is bleeding in the early course after implantation. This can lead to compression of the SVC with consecutive signs of tamponade and low output of the TAH. In this case the only therapy option is immediate reoperation to excise the pericardium from the effusion and to detect the bleeding source. In patients with a long-term TAH, the interventional therapy of compression of the SVC because of pericardial effusion is, in our opinion, possible if no actual bleeding source can be detected. Most important for this interventional procedure is to avoid the blockade of the valve of the artificial right ventricle with the

guidewire. The advantages are obvious: there is no need to change the anticoagulation therapy, a reoperation procedure with all its perioperative risks can be avoided, and the patient can be discharged home rapidly.

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